

# The Effect of State Cigarette Tax Increases on Cigarette Sales, 1955 to 1988

## ABSTRACT

We evaluated the effect of state cigarette tax increases on cigarette sales in the 50 states for the years 1955 to 1988. State cigarette tax increases were associated with an average decline in cigarette consumption of three cigarette packs per capita (about 2.4%). Larger tax increases were associated with larger declines in consumption. Raising state cigarette taxes appears to be an effective public health intervention that can reduce cigarette consumption and its associated health consequences. (*Am J Public Health*. 1992; 82:94-96)

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### Introduction

Numerous studies have observed that cigarette consumption decreases when the price of cigarettes increases.<sup>1-6</sup> Although cigarette tax increases have generally been enacted to raise revenues, such tax increases have raised the price of cigarettes and are believed to have led to reductions in cigarette consumption. There was a substantial drop in national cigarette sales in 1983 following the increase of the federal cigarette excise tax from 8 to 16 cents on January 1, 1983. Several observers have commented on this as a cause-effect relationship.<sup>7-11</sup> It is likely that state cigarette tax increases, of which there have been 248 during the years 1955 through 1988, have had similar effects. In this context, we undertook the present study to assess changes in cigarette consumption following state cigarette tax increases and to quantify the amount of the change in cigarette consumption by the size of tax increase.

### Methods

Annual data on cigarette packs per capita (number of packs sold in the state divided by the state's population), average retail price in the state, and state cigarette taxes were obtained from the Tobacco Institute.<sup>12</sup> Data were available from 1955 or when a state first imposed a cigarette tax, whichever was later. We converted all tax and price data to constant (1983) dollars.<sup>13</sup> Data on the enactment of state clean indoor air acts were obtained from the surgeon general's 1989 report.<sup>7</sup>

We defined the change in cigarette consumption for each state and each year as the difference between the sales in that state in the preceding year and the sales in the following year. Calculating the differences in sales for each of the states for each year of the study period gave us 1536 observations of changes in cigarette consumption. We adjusted for national trends in cigarette consumption by subtracting the national change in consumption for that year from each state value. This has

the effect of controlling for national events, such as the 1983 federal tax hike, as well as national trends in sales due to such factors as national demographic trends and antismoking publicity.

To explore the effect of state tax increases on cigarette consumption, we compared changes in cigarette consumption for states in years with tax increases against states in years with no tax increase. We then categorized observations by the size of the tax increase and compared changes in cigarette consumption. We also categorized observations by the presence or absence of a new clean indoor air act and compared changes in cigarette consumption.

Means and standard errors of the categorized changes in cigarette consumption were computed. The standard errors were calculated using pooled estimates of the variance across subgroups, accounting for correlation among repeated events within a given state using the robust variance method of Zeger and Liang.<sup>14</sup>

After analyzing the data for the entire period (1955 through 1988), we looked at the effects in each of three time intervals: 1955 through 1964 (until the surgeon general's first report on smoking), 1965 through 1978 (when per-capita cigarette

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**Editor's Note.** See related editorial by Wasserman on page 19.

TABLE 1—Change in Cigarette Consumption by State Tax and State Clean Indoor Air Act, United States, 1955–1988

	Change in Consumption (cigarette packs per capita)			
	1955–1988	1955–1964	1965–1978	1979–1988
Tax increase				
Yes	–3.0 <sup>a</sup>	–3.3 <sup>a</sup>	–3.8 <sup>a</sup>	–1.5 <sup>a</sup>
No	0.6 <sup>a</sup>	0.7	0.7	0.3
Size of tax increase				
<4.0 cents	0.8	–0.9	6.9 <sup>a</sup>	–0.6
>4.0–6.0 cents	–1.5	–3.8	–1.5	–1.2
>6.0–8.0 cents	–4.6 <sup>a</sup>	–4.7 <sup>a</sup>	–5.0 <sup>a</sup>	–3.8 <sup>a</sup>
>8.0 cents	–7.3 <sup>a</sup>	–8.7 <sup>a</sup>	–7.4 <sup>a</sup>	–3.1
Clean indoor air act				
Yes	–0.1	...	–1.5	0.1
No	0.0	...	0.3	0.0

Note. Average capita consumption nationally for the period was 124.1 packs per capita (1955–1964, 119.5; 1965–1978, 126.6; 1979–1988, 125.0).

<sup>a</sup>95% confidence interval does not include zero

consumption peaked), and 1979 through 1988 (a period of declining consumption).

## Results

Cigarette consumption declined by an average of 3.0 packs per capita in the 248 observations with a tax increase. In contrast, cigarette consumption rose by 0.6 packs per capita in the 1288 observations with no tax increase (Table 1). Stratification of the change in cigarette consumption by the size of tax increase yielded a clear dose-response relationship: the larger the increase in taxes, the larger the decrease in consumption (Table 1).

Regressing the size of tax increase on the change in cigarette consumption, we found that for each 1-cent increase in cigarette taxes, sales fell by 0.75 packs per capita (about 0.6%). Performing a separate regression on the data for each of the three time periods, we found that while in each period the effect of tax on sales was consistent and dose related, it appears that a given size of tax increase had less effect in recent years (sales fell by 0.85, 0.78, and 0.48 pack per penny tax increase for the time periods 1955 through 1964, 1965 through 1978, and 1979 through 1988, respectively).

No consistent relationship was found between the enactment of state clean indoor air acts and changes in cigarette consumption.

## Discussion

Our results are consistent with the econometric literature on cigarettes, in which estimated price elasticity for ciga-

rettes (the percentage change in sales as a result of a 1% change in price) has ranged from –0.14 to –1.44 depending on the methods used and the populations studied. Reviewing this literature, the surgeon general's 1989 report used –0.47 as an estimate of the price elasticity for the general population.<sup>7</sup> In our study, using a rough conversion from our tax-response format to an elasticity format, we found an elasticity of –0.49 (in this case the elasticity representing a sales decline of 0.49% for every 1% of cigarette price that the tax increase accounted for).

Despite the strong and consistent relationship observed, it could be argued that changing public opinion regarding smoking precedes and causes both a tax increase and a decrease in cigarette sales. This hypothesis seems unlikely, as we found the same relationship between tax increases and declines in cigarette sales even in the first period of the analysis, 1955 through 1964, a period before the surgeon general's first report and a time when little antismoking sentiment existed. Additionally, the enactment of a clean indoor air act, a similar legislative event that would seemingly also reflect such an underlying public opinion shift, was not found to be related to changes in cigarette consumption.

Other studies<sup>4,5</sup> have found some evidence for a relationship between enactment of a state clean indoor air act and reductions in cigarette consumption. We conclude, from our analysis, that if cigarette consumption declines occurred at the time of enactment of state clean indoor air acts, they were small compared with those seen with tax increases. Alternatively, state clean indoor air acts may have

a delayed and more gradual effect on cigarette consumption, and may therefore have escaped our detection.

While our approach is conceptually easy to understand, it is limited in that we were not able to control for potential biases, such as state-to-state differences in sales or price trends, or to examine two effects simultaneously, such as the interaction of taxes and clean indoor air acts. To evaluate whether these limitations were an important factor in our results, we did a second analysis, using a longitudinal model,<sup>15,16</sup> in which we were able to control for state-specific trends over time and to examine the role of multiple variables simultaneously. The results of this second analysis were essentially the same as the first analysis. Restricting the analysis to 21 states reported to have little or no problem with bootlegging<sup>17</sup> (cigarettes purchased in one state and consumed in another) also did not change the results.

We have used an epidemiologic approach to evaluate the effect of a state-based public health intervention—the enactment of cigarette excise tax increases. Our results provide further evidence that state tax increases are effective in reducing smoking and that the larger the tax increase, the larger the drop in cigarette smoking. □

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## Mass Media-Led Antismoking Campaign Can Remove the Education Gap in Quitting Behavior

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### ABSTRACT

This study investigated whether the effective mass media-led antismoking campaigns in Australia had the traditional differential effect across educational levels. Our population surveys included random samples of 12 851 people before the campaign and 11 609 several years after the campaign had started. No statistically significant differences were found in quitting across education levels in three of the four subgroups. Mass media-led antismoking campaigns may play an important role in getting the antismoking message to the less educated. (*Am J Public Health*. 1992;82:96-98)

### Introduction

A major public health concern in developed countries is the increasing gap in smoking prevalence between educational groups.<sup>1</sup> In the United States, Canada, and Norway, smoking in the least educated groups is approximately twice as prevalent as in the most educated groups, and the rate of decline in smoking behavior is three to nine times lower.<sup>2</sup> Evidence indicates that those who are less educated obtain information from visual media (such as television) more often than those who are more educated.<sup>3</sup> If one barrier to less educated people changing their smoking behavior is the lack of access to motivational information,<sup>4</sup> use of a mass media-led antismoking campaign may reduce smoking prevalence overall without widening the gap between educational groups.

During the 1980s, mass media-led antismoking campaigns were conducted in two Australian capital cities, Sydney and Melbourne.<sup>5,6</sup> The Sydney campaign began in mid-1983, 1 year before the start of the Melbourne campaign. Using Melbourne as a control, Sydney showed a marked decline of 2.5% in smoking prevalence, a decline attributable to the campaign in the first year.<sup>7</sup> Subsequent results showed a similar decline in Melbourne in its first campaign year, and a continued de-

cline over the next 4 years for men in each city.<sup>8</sup> Among adults, the decline in prevalence was primarily owed to quitting.<sup>7</sup>

During the years in which such campaigns were run, more than two thirds of the communities in both cities recalled television advertisements depicting the health consequences of smoking.<sup>8</sup> In this paper, we investigate whether the effects of this campaign differed by educational level.

### Methods

A subset of the large Australian database was used for this study, which followed a "before-after" design.<sup>8</sup> Members of the "before" group (n = 12 851), aged 25 to 54, were interviewed in Sydney and Melbourne over a year starting in mid-

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